1. Mark your confusion.
2. Show evidence of a close reading.
3. Write a 1+ page reflection.

Sorry, Your Paper Coffee Cup Is a Toxic Nightmare

Supposedly eco-friendly cups are still coated with a thin layer of plastic, which scientists have discovered can leach chemicals that harm living creatures.

Source: Sabrina Weiss, Wired.com, September 1, 2023

The world goes through hundreds of billions of single-use coffee cups every year—and most aren't recycled. So major coffee chains' switch to paper cups is a good step, right? Not quite.

A 2023 study shows that paper cups can be just as toxic as conventional plastic ones if they end up littered in our natural environment. Seemingly eco-friendly paper cups are coated with a thin layer of plastic to keep their contents from seeping into the paper, and this lining can emit toxic substances. "There are chemicals leaching out of these materials," says lead author Bethanie Carney Almroth, an associate professor of environmental science at the University of Gothenburg in Sweden.

When trying to assess the environmental impact of takeaway coffee cups, most experiments have focused on plastic lids and polystyrene cups. Paper cups have long been spared scrutiny. To address this oversight, Carney Almroth and her colleagues tested the effects of paper and plastic cups on midge larvae, which are commonly used in toxicity tests. The cups were placed in temperate water or sediment and left to leach for up to four weeks. The larvae were then kept in aquariums containing the water or sediment tainted by the paper and plastic cups. Regardless of the source of the contamination, the larvae grew less in the sediment, and exposure to the tainted water also hindered their development.

The ecotoxicologists didn't perform chemical analyses to see which substances had leached from the paper cups into the water and sediment, though Carney Almroth suspects that a mix of chemicals caused the damage. But it's hard to say more, given that it's not known which materials are present. "This would all be much easier if companies were required to tell us what they use in their products," she says.

Coffee cups are made of a complex mixture of synthetic materials and chemicals. Manufacturers add processing aids, heat stabilizers, and other substances, many of which are known to be toxic. Even if plant-derived materials are used—such as polylactic acid, a material derived from corn, cassava, or sugarcane that's used to coat paper cups—cup makers often add a number of other chemicals during processing.

Chemical analyses can sometimes shed light on the composition of the substances present in a plastic or paper cup, but even these tests can't always identify what's there, says Jane Muncke, who is an environmental toxicologist by training and now managing director of the Food Packaging Forum, a Switzerland-based science communication organization. The exact substances are "unknown not only to the scientists who carry out these analyses, but also to the people who produce and sell the packaging." During the manufacture of plastic-containing products, unintentional chemical reactions can take place between the materials used to create new substances.

Chemicals can also be harmful because of the specific combinations they are used in, Muncke adds—something known as "mixture toxicity." It thus makes little sense to regulate the amounts of individual substances in cups, she says, because you still can't be sure what impact they'll have.

Improving recycling practices would be a logical step in trying to keep harmful chemicals from ending up in nature, but researchers say it's best to retire disposable paper cups altogether. It's difficult for most recycling centers to separate the plastic coating from the cup's paper. In the UK, for instance,

a mere handful of recycling centers take paper cups. Many coffee shops will collect them for recycling—but having to drop paper cups off takes the convenience out of a single-use product. Today, only four out of every 100 paper cups are recycled in the UK.

Plus, leaching chemicals isn't just a problem when paper cups are littered—it can begin when a cup is used. In 2019, a research group from India filled paper cups with hot water to see if plastic particles or chemicals were released. "What came as a surprise to us was the number of microplastic particles that leached into the hot water within 15 minutes," Anuja Joseph, a research scholar at the Indian Institute of Technology in Kharagpur, wrote in an email. On average, there were 25,000 particles per 100 ml cup. The researchers also found traces of harmful chemicals and heavy metals in the water and plastic lining, respectively.

"Reusable" cups aren't necessarily much better when it comes to leaching, as they are often made of plastic; heat and wear accelerates leaching, and acidic drinks like coffee absorb chemicals more easily. The carbon footprint of reusable plastic cups is also disputable: A reusable cup has to be used between 20 and 100 times to offset its greenhouse gas emissions compared to a disposable one, according to some estimates. Blame the high amount of energy needed to make the reusable cup durable and the hot water needed to wash it. That said, a reusable plastic cup at least has the potential to last longer and is easier to recycle.

For Carney Almroth, reusable plastic cups aren't the answer; fewer raw materials should be extracted and processed into plastics, she believes. "But we also need to look at the alternatives that are put forth as we make a shift into something more sustainable to make sure that we're not just replacing one product with another," she says. Carney Almroth is part of a coalition of scientists who contributed evidence to the negotiations for a global plastics treaty.

In the meantime, the search is on for safer and more sustainable solutions. Some companies have baked edible cups made of waffles or biscuits or have used an origami-like technique to fold paper into cups. Both Carney Almroth and Muncke see the potential for companies to use established materials to shape a circular economy. Then the coffee shops could more easily replace their low-cost plastic and paper cups.

Take glass, for instance, which keeps drinks warm for longer—its low thermal conductivity slows the heat in the liquid from dispersing in the cup—and it is chemically inert, meaning no leaching (even the glaze of a ceramic cup is slightly soluble and can leach out to some degree). But although glass is infinitely recyclable, it has a higher environmental footprint than plastic. It's made from natural raw materials such as sand, which have to be mined and melted at very high temperatures.

Stainless steel, a metal commonly used for reusable water bottles, is another contender. But coffee in steel cups cools faster than it would in ceramic and glass cups because the heat is transferred to the material and then to the palm of your hand. However, the material is more robust, making it good for on-the-go drinks.

Regardless of which material proves successful, moving away from disposable cups will take innovative business models and approaches, says Muncke. By this, she means companies finding a viable way to rent out and collect reusable cups, wash them appropriately, make sure they're not contaminated, and then put them back into circulation. "The difficult thing is changing people's behavior and building all the infrastructure. And that costs a lot of money." Convenience and cheapness will make disposable cups hard to overthrow.

Possible Response Questions

- What are your thoughts about the toxicity of paper cups ? Explain.
- Did something in the article surprise you? Discuss.
- Pick a word/line/passage from the article and respond to it.
- Discuss a "move" made by the writer in this piece that you think is good/interesting. Explain.